Volume 13, Number 4 October 2000

JTSTEB 13(4) 537–752 (2000)

http://www.wkap.nl/journalhome.htm/0894-9867 ISSN 0894-9867

Journal of Traumatic Stress

KLUWER ACADEMIC / PLENUM PUBLISHERS

Journal of Traumatic Stress, Vol. 13, No. 4, 2000

Predictors of Emotional Numbing, Revisited: A Replication and Extension

William F. Flack, Jr.,[1,4] Brett T. Litz,[2] Frank Y. Hsieh,[3] Danny G. Kaloupek,[2] and Terence M. Keane[2]

Litz et al. (1997), theorizing that emotional numbing (EN) is the result of emotional depletion caused by chronic hyperarousal, demonstrated that a cluster of hyperarousal symptoms was a robust predictor of EN symptoms. In the present study, these findings were replicated and extended in two multiple regression analyses of data from a large, multisite investigation (T. M. Keane et al., 1998) of psychophysiological responding by male combat veterans. The arousal (D) cluster of symptoms was again the most robust predictor of EN symptoms, whereas physiological indices of arousal and reactivity accounted for negligible amounts of variance in both regression equations. These findings underscore the possible link between disturbances related to arousal and the capacity of traumatized individuals to express and experience pleasant feelings.

KEY WORDS: posttraumatic stress disorder; emotional numbing.

Symptoms of emotional numbing (EN) include markedly diminished interest in activities, feeling distant or cut off from others, and restricted range of affect (American Psychiatric Association [APA], 1987, 1994). Each of these symptoms is likely to impair both intrapersonal and interpersonal functioning. Despite their apparent clinical importance, however, very little is known about EN within the overarching syndrome of PTSD.

Crucial to the development of meaningful research on EN is a definition of the construct that is specified adequately for purposes of empirical research

Heidi S. Resnick was the associate editor for this manuscript.
[1]Department of Psychology, Indiana University of Pennsylvania.
[2]Boston Department of Veterans Affairs Medical Center and Boston University School of Medicine.
[3]Palo Alto Department of Veterans Affairs Health Care System.
[4]To whom correspondence should be addressed at Department of Psychology, Bucknell University, Lewisburg, Pennsylvania 17837; e-mail: wflack@bucknell.edu.

(Litz, 1992). The lack of such an operational definition may be one reason why research on emotional deficits has lagged behind work on the more flagrant emotional responses to trauma, such as fear and anger, which are more readily specified. Furthermore, Litz (1992) pointed to significant discrepancies between the three major theories on the role of EN in PTSD and the results of associated research. For example, although behavioral theory indicates that EN is caused by the avoidance of reactions to and reminders of traumatic events (e.g., Keane, Fairbank, Caddell, Zimering, & Bender, 1985), the results of empirical investigations indicate that clusters of avoidance and EN symptoms are statistically independent (Foa, Riggs, & Gershuny, 1995; Litz et al., 1997). In information-processing theories, EN is viewed as a separate phase of adjustment that occurs in response to reexperiencing and the associated experience of highly aversive emotions (e.g., Horowitz, 1986). However, attempts to demonstrate empirically that EN is a separate phase of adjustment to trauma have thus far been unsuccessful (e.g., Joseph, Yule, & Williams, 1995). In animal models of PTSD, EN is likened to a conditioned analgesia in response to inescapable shock (e.g., Foa, Zinbarg, & Rothbaum, 1992; Pitman, van der Kolk, Orr, & Greenberg, 1990). In the case of this theory, however, adequate experimental evidence of a relationship between emotional behavior and conditioned analgesia in humans is not yet forthcoming. Finally, it remains unclear whether EN symptoms are distinct from other conditions that typically accompany a diagnosis of PTSD, such as depression and substance abuse.

Litz et al. (1997) used a multivariate approach to study the association among EN (a composite of DSM-III-R defined symptoms: disinterest, detachment, and restricted range of affect), other DSM-III-R defined PTSD symptom clusters, and common comorbid conditions. They hypothesized that the cluster of hyperarousal symptoms would be uniquely associated with EN. This hypothesis is based on the theory that EN symptoms are deficits caused by the depletion of biological, cognitive, and emotional resources, which, in turn, is caused by the chronic hyperarousal shown by traumatized persons (Barlow, 1988; Foa et al., 1992; Litz, 1992). Litz et al. found that after controlling for other factors previously shown to be related to PTSD, including race, age, extent of war-zone exposure, depression, substance abuse, and PTSD symptom cluster-B (reexperiencing symptoms), cluster-C (the other avoidance symptoms), and cluster-D (hyperarousal symptoms), the symptom cluster-D was the best predictor of the EN composite.

The present study was an attempt to replicate and extend the findings of Litz et al. (1997) to the symptom groupings as defined in the current nosology (DSM-IV; APA, 1994). In the previous version of this diagnostic system (DSM-III-R; APA, 1987), physiological reactivity was included within the hyperarousal symptom cluster. In this study, reactivity was disaggregated from the hyperarousal cluster by adopting the more coherent grouping of B (reexperiencing) and D (hyperarousal) symptoms contained in the DSM-IV. We also extended the work of Litz et al. (1997) by using multiple indicators of hyperarousal and hyperreactivity, including measures based on self-report and on physiological indicators. Consistent with the depletion-of-resources theory cited previously, we hypothesized that the revised cluster of hyperarousal symptoms would again be the most robust predictor of EN symptoms, and that physiological indicators of arousal would also be significantly related to EN symptoms.

Method

Participants and Procedure

The data for this study came from the Department of Veterans Affairs Cooperative Study on psychophysiological measurement in the diagnosis of PTSD (Keane et al., 1998). The sample of subjects with complete data from this study consisted of 1,168 male, service-seeking or service-using Vietnam theater veterans recruited from 15 different sites, and divided into three groups based on DSM-III-R (APA, 1987) diagnoses of PTSD (current, lifetime, never). Among the comprehensive set of psychodiagnostic measures administered to each subject were the War Stress Interview (WSI; Rosenheck & Fontana, 1989), the Structured Clinical Interview for the DSM-III-R (SCID; Spitzer, Williams, Gibbon, & First, 1990) (including the PTSD module), the second edition of the Minnesota Multiphasic Personality Inventory (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1990), the Combat Exposure Scale (CES; Keane et al., 1989), and the Mississippi Scale for Combat-Related PTSD (Mississippi; Keane, Caddell, & Taylor, 1988).

Subjects also participated in a psychophysiological challenge task, in which combat-related and neutral audiovisual displays and imagery scenes were used as stimuli. The two sets of displays, one containing images and sounds from the Vietnam war, and the other containing outdoor scenes paired with classical piano music, were presented on videotape. The two sets of scenes, one consisting of scripts written by the subjects and their research clinicians (in order to depict the most stressful combat events experienced by each subject), and the other consisting of two neutral scripts depicting scenes in a lawn chair and at a beach, were presented via audio format only. A set of psychophysiological and self-report measures was taken during baseline and stimulus presentation periods. Of this set, heart rate (HR; measured in beats per minute) and subjects' self-reports of their subjective distress (made by means of the Subjective Units of Distress Scale, SUDS) were chosen for purposes of the present study. (See Keane et al., 1998, for a more comprehensive description of the sampling and assessment procedures used in the original study.)

Derivation of Samples, Predictor Variables, and Indices of Internal Consistency

We conducted two sets of hierarchical multiple regression analyses in order to examine the individual and combined contributions of a series of variables to the prediction of EN. Each set of analyses was applied to two subsamples from the original set of data, one to test the study hypotheses, and the other to cross-validate those findings. Subjects were randomly assigned to the test (calibration) sample, consisting of 696 subjects (66% of the total), and the remaining 349 subjects (33% of the total) were assigned to the validation sample.

The criterion and predictor variables were constructed in the following manner. First, a composite EN index (criterion) was derived by summing the instances in which the three EN items from the SCID (less interested in activities, feeling distant or cut off from others, no longer having strong feelings) were coded as "present." This sum was converted to a z-score. Seven items, each reflecting aspects of emotional expression or feeling, were selected from the Mississippi Scale (able to get emotionally close, seems as if I have no feelings, do not laugh or cry, enjoy many things, enjoy the company of others, no one understands how I feel, have a hard time expressing feelings). These items were summed, and this sum score was converted to a z-score. The EN index consisted of the mean of the two resulting z-scores.

Additional predictor variables were (a) age, total years of education, and race (Caucasian vs. other); (b) total score on the Combat Exposure Scale; (c) the raw score for the Depression scale on the MMPI-2; (d) a composite variable for alcohol use and abuse, based on items from the War Stress Interview (number of days regularly drinking, number of years regularly drinking, loss of friends due to drinking, trouble at work due to drinking, neglecting obligations due to drinking); and (e) a composite variable for drug use and abuse, also based on WSI items (number of days/number of years using opiates, tranquilizers, cocaine, amphetamines, cannabis, and hallucinogens). Composite variables were also created for the PTSD symptom clusters of reexperiencing (B), avoidance (C, minus the EN symptoms), and arousal (D) in a manner similar to that used to construct the EN index, using items from the SCID and the Mississippi Scale, and conforming to the groupings of symptoms contained in the DSM-IV.

Predictor variables based on data from the psychophysiological challenge tasks were constructed in the following manner. The index of hyperarousal consisted of the lowest of six mean values for 30-s periods of heart rate (HR) during an initial resting baseline period. The index of physiological reactivity was calculated as the difference between the highest 30-s mean for HR following presentation of a neutral stimulus, and the highest 30-s mean for HR following presentation of a combat stimulus. Subjective reactivity was represented by a comparable difference score based on SUDS ratings (0–10). This score was the difference between the highest SUDS rating following presentation of a combat stimulus and the highest SUDS rating following presentation of the neutral stimulus. Finally, an index reflecting the interaction of physiological and subjective reactivity was computed by multiplying the two reactivity variables.

Cronbach's alpha was computed for each of the standardized composite indices, in both subsamples, in order to assess their internal consistencies. Results of these computations for the test and validation subsamples, respectively, were as follows: reexperiencing (B symptoms) composite alpha = .67 and .66, avoidance (C symptoms, minus EN) alpha = .71 and .70, arousal (D symptoms) alpha = .68 and .66, EN index alpha = .90 and .90, interaction of heart rate and subjective ratings of distress alpha = .80 and .78, alcohol use/abuse composite alpha = .77 and .78, and drug use/abuse composite alpha = .79 and .79.

Results

Fourteen predictor variables were identified for potential inclusion in a multiple regression model applied to the calibration sample. As an initial step, Pearson correlation coefficients were calculated between the EN index and each of these 14 variables (see Table 1). Among them, hyperarousal has the highest correlation, followed by reexperiencing, depression, and avoidance.

Forward stepwise regression (SAS REG procedure) was applied to the calibration sample, with the significance level set at .05 for entry into the model, and at .15 for retention in the model. The hyperarousal variable entered first, based on its p-value, followed by the variables for depression, reexperiencing, avoidance, and race. The parameter estimates and model R-squared values for each of these five predictor variables are presented in Table 2. It is apparent that hyperarousal has the highest incremental R-square value by far, given its initial position in the order. In addition, z-scores, calculated by dividing each parameter estimate by its associated standard error, demonstrate that hyperarousal is the strongest predictor with a value of 11.3 compared to the next highest value of 9.0 for depression.

Table 1. Correlations Between Emotional Numbing Index and Predictor Variables Across Subsamples

Predictor variable	Test subsample[a]	Validation subsample[b]
Age (years)	−.22**	−.18**
Education (years)	−.22**	−.29**
Race (Caucasian)	.03	−.01
Combat exposure scale	.36**	.33**
MMPI-2 depression	.66**	.62**
Alcohol index	.22**	.17**
Drugs index	.17**	.13*
Reexperiencing symptoms	.73**	.72**
Avoidance symptoms	.57**	.58**
Arousal symptoms	.78**	.77**
Baseline heart rate	.14**	.07
Heart rate reactivity	.20**	.19**
Subjective reactivity	.23**	.22**
Reactivity interaction	.17***	.15**

[a]Sample size for these correlations ranges from 772 to 813.
[b]Sample size for these correlations ranges from 389 to 411.
*$p < .01$. **$p < .001$.

Table 2. Parameter Estimates and Model R-Squares for Predictors of Emotional Numbing

Predictor variable	Calibration subsample B	Calibration subsample $SE\ B$	Model R-square	Validation subsample B	Validation subsample $SE\ B$
Intercept	−0.85*	0.09	—	−0.60*	0.13
Hyperarousal	0.41*	0.04	0.63	0.44*	0.05
Depression	0.03*	0.00	0.67	0.02*	0.00
Reexperiencing	0.21*	0.04	0.70	0.17*	0.05
Avoidance	0.12*	0.03	0.70	0.12*	0.04
Race	0.13*	0.04	0.71	0.05	0.06

*$p < .01$.

In Table 2 the parameter estimates obtained when the five predictor variables were entered simultaneously into a regression model applied to the validation sample are also given. The aim of this analysis was to examine the replicability of the results for the calibration sample. The z-score for hyperarousal (8.3) again was highest, this time by a margin of 3 units. Only the variable representing race failed to reach statistical significance ($p = .40$). These results demonstrate that hyperarousal is the strongest individual predictor in the model, although depression, reexperiencing, and avoidance all contribute as well.

Discussion

Consistent with our predictions and with the findings of Litz et al. (1997), the cluster of hyperarousal symptoms based on DSM-IV criteria was the strongest predictor of EN symptoms endorsed by the Vietnam veterans examined in this study. This replicates the earlier finding that EN and hyperarousal symptom endorsements are strongly associated. Furthermore, it is consistent with the hypothesis that there is a causal relationship between EN and chronic hyperarousal. In individuals with PTSD, high arousal states and problems linked to hyperarousal may affect problems related to emotional numbing (disinterest, detachment, restricted range of affect) in a number of different ways. For example, patients with PTSD may be hypersensitive to even mild challenges or demands caused by neuroendocrine dysregulation (Yehuda, Teicher, Levengood, Trestman, & Siever, 1996). The resultant stress reaction produces negative affects that are incompatible with positive feelings (e.g., anger). Stress responses also restrict the capacity to process emotions caused by the depletion of cognitive resources (i.e., limits in attention and concentration; see Litz, 1992). In addition, states of high arousal and negative affect suppress appetitive behavior and motivation (e.g., Lang, Bradley, & Cuthbert, 1990).

It is also possible that EN and hyperarousal problems are reciprocally interactive. For example, research has shown that individuals who suppress their emotional reactions to evocative stimuli exhibit higher arousal (e.g., Gross & Levenson, 1993). In addition, expressive behaviors that are muted or ambiguous, or that reflect disinterest and detachment, are less likely to elicit empathic behaviors from significant others, which may affect problem-solving abilities and exacerbate stress (see Levenson & Ruef, 1992).

Reexperiencing and avoidance symptoms were also significantly related to EN in both subsamples, although their relative predictive contributions were considerably lower in magnitude than that of hyperarousal. Nevertheless, this finding suggests that reexperiencing symptoms and strategic avoidance behaviors play a role in reports of EN. Although there was a very strong zero-order association between the EN index and depression, there was virtually no association between EN and depression after controlling for the other variables in the model. This suggests that the construct of EN is distinct from depression, a finding that is consistent with the findings of a recent study (Litz, Orsillo, Kaloupek, & Weathers, 2000).

Unexpectedly, the measures of psychophysiological responding in the laboratory failed to predict symptom reports of EN, although there was a moderate zero-order correlation between the EN index and indicators of phasic arousal in response to trauma-related cues. This may have been due to stark differences in method variance. The self-report arousal composite is best understood as a heterogeneous trait measure of hyperarousal and related difficulties, whereas the psychophysiological measures of arousal were state measures of physiological activity in the laboratory. It is not surprising, then, that results based on these sets of measures fail to correspond with each other because they cover very different periods of time and response formats. The results of this study, when seen in the context of findings from the study of Litz et al. (1997), nevertheless underscore the possible link between disturbances related to arousal and the capacity of traumatized individuals to experience or express feeling states.

Acknowledgments

We acknowledge the work of Ms. Yajie Wang, who conducted the programming required for the statistical analyses contained in this paper. We also acknowledge the support of the Department of Veterans Affairs, Cooperative Study Project Center, which funded the original project.

References

American Psychiatric Association (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.

American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Barlow, D. H. (1998). *Anxiety and its disorders.* NY: Guilford Press.

Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaemmer, B. (1990). *Minnesota Multiphasic Personality Inventory (MMPI-2): Manual for administration and scoring*. Minneapolis: University of Minnesota Press.

Foa, E. B., Riggs, D., & Gershuny, B. (1995). Arousal, numbing, and intrusion: Symptom structure of PTSD following assault. *American Journal of Psychiatry, 152,* 116–120.

Foa, E. B., Zinbarg, R., & Rothbaum, B. (1992). Uncontrollability and unpredictability in post-traumatic stress disorder: An animal model. *Psychological Bulletin, 112,* 218–238.

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology, 64,* 970–986.

Horowitz, M. (1986). *Stress response syndromes* (2nd ed.). Northvale, NJ: Jason Aronson.

Joseph, S., Yule, W., & Williams, R. (1995). Emotional processing in survivors of the Jupiter cruise ship disaster. *Behaviour Research and Therapy, 33,* 187–192.

Keane, T. M., Caddell, J. M., & Taylor, K. L. (1988). Mississippi Scale for combat-related posttraumatic stress disorder: Three studies in reliability and validity. *Journal of Consulting and Clinical Psychology, 56,* 85–90.

Keane, T. M., Fairbank, J. A., Caddell, J. M., Zimering, R. T., & Bender, M. E. (1985). A behavioral approach to assessing and treating post-traumatic stress disorder in Vietnam veterans. In C. R. Figley (Ed.), *Trauma and its wake* (pp. 257–294). New York: Brunner Mazel.

Keane, T. M., Fairbank, J. A., Caddell, J. M., Zimering, R. T., Taylor, K. L., & Mora, C. A. (1989). Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment, 1,* 53–55.

Keane, T. M., Kolb, L. C., Kaloupek, D. G., Orr, S. P., Blanchard, E. B., Thomas, R. G., Hsieh, F. Y., & Lavori, P. W. (1998). Utility of psychophysiological measurement in the diagnosis of post-traumatic stress disorder: Results from a Department of Veterans Affairs Cooperative Study. *Journal of Consulting and Clinical Psychology, 66,* 914–923.

Lang, P., Bradley, M., & Cuthbert, B. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97,* 377–395.

Levenson, R. W., & Ruef, A. M. (1992). Empathy: A physiological substrate. *Journal of Personality and Social Psychology, 63,* 234–246.

Litz, B. T. (1992). Emotional numbing in combat-related post-traumatic stress disorder: A critical review and reformulation. *Clinical Psychology Review, 12,* 417–432.

Litz, B. T., Orsillo, S., Kaloupek, D., & Weathers, F. W. (2000). Emotional-processing in PTSD. *Journal of Abnormal Psychology, 109,* 26–39.

Litz, B. T., Schlenger, W. E., Weathers, F. W., Caddell, J. M., Fairbank, J. A., & LaVange, L. M. (1997). Predictors of emotional numbing in post-traumatic stress disorder. *Journal of Traumatic Stress, 10,* 607–617.

Pitman, R. K., van der Kolk, B. A., Orr, S. P., & Greenberg, M. S. (1990). A symptom provocation study of posttraumatic stress disorder using positron emission tomography and script-driven imagery. *Archives of General Psychiatry, 53,* 380–387.

Rosenheck, R., & Fontana, A. (1989). *War Stress Interview (WSI)*. West Haven, CT: Department of Veterans Affairs, Northeast Program Evaluation Center.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., & First, M. D. (1990). *Structured clinical interview for DSM-III-R-Patient version (SCID-P)*. NY: New York State Psychiatric Institute, Biometrics Research Division.

Yehuda R., Teicher M. H., Levengood R., Trestman R., & Siever L. J. (1996). Cortisol regulation in posttraumatic stress disorder and major depression: A chronobiological analysis. *Biological Psychiatry, 40,* 79–88.